PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Improvements in or relating to a method of measuring Low Pressures with an Ionisation Gauge comprising a Cold Cathode

We, SIEMENS & HALSKE AKTIENGESELLSCHAFT, a German Company, of Siemensstadt, Berlin, Germany, and Wittelsbacher Platz 4, Munich 2, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention is for improvements in or relating to a method of measuring low pressures with an ionisation gauge comprising a cold cathode.

It is known to employ ionisation gauges having a cold cathode for measuring low pressures. Such a proposed measuring arrangement is distinguished, for example, by the employment of a cylindrico-symmetrical electrode arrangement in a magnetic field coaxial therewith. In one construction, for example, there is disposed within a cylindrical cathode an anode which is rotationally symmetrical thereto. The operating voltage of the glow discharge of such a cold-cathode pressure gauge decreases considerably with increasing pressure, and amounts, for example, to 5 kV. at 10^{-5} mm. mercury, falling to 1 kV. at 10^{-2} mm. mercury. At higher pressure, the operating voltage is still lower. At pressures above 10^{-2} mm. mercury, the discharge current of the measuring tube is determined substantially by the resistance (for example 2 megohms) necessary in the circuit. This current is thus limited, and consequently a pressure measurement in these regions is very inaccurate or is possible only with a considerable increase in the power at the measuring tube. Considerable heating and cathode atomisation must be expected when working with high power at the measuring tube, with consequent unreliability in the gas pressure of the tube.

[Price 2s. 8d.]

The present invention relates to a method of measuring low pressures with an ionisation gauge having a cold cathode, more particularly for measuring pressures of up to 10^{-1} mm. mercury, and has for its object to obviate the aforesaid disadvantages. While such measuring arrangements have hitherto been operated at a constant operating voltage it is proposed, in accordance with the present invention, to maintain the discharge current of the measuring tube at a constant value and, for the purpose of the pressure measurement, to measure the voltage at the measuring tube, or both at the measuring tube and at a series resistance associated therewith. The discharge current of the measuring tube may be adjusted, for example, to 20, 50 or 100 μA.

In this way, it is possible to cover the entire pressure range of up to 10^{-1} mm. mercury which is to be covered by the instrument, without any possibility of undesirably high heating of the tube.

The present invention will be more particularly described with reference to the accompanying drawings in which:—

Figure 1 illustrates an arrangement of a hand operated regulator.

Figure 2 illustrates a graph indicating the pressure as a function of the voltage in accordance with the present invention.

Figure 3 illustrates a circuit arrangement according to the present invention, and

Figure 4 illustrates a further circuit arrangement in accordance with the present invention.

Referring to the drawings and in particular to Figure 1 there is illustrated a high-voltage generator 1 which is associated with a measuring tube 2. The said measuring tube 2 contains, for example, within a cylindrical cathode 3 an anode 4 axially symmetrical thereto. There is also provided a series resistance 5 in the

discharge circuit of the measuring tube 2. The discharge current may be adjusted to a constant value with the aid of a manually adjustable regulator. The discharge current is indicated by an instrument 7. The pressure itself is indicated on a voltmeter 8. The measuring scale of this instrument may be directly calibrated in mm. mercury in accordance with the curve illustrated in Figure 2, which indicates the pressure p as a function of the voltage u.

The circuit arrangement for carrying out the method according to the present invention is so designed that the discharge current of the measuring tube is maintained constant by an automatic regulator. A constructional example of this is diagrammatically illustrated in Figure 3. Parts identical with those illustrated in Figure 1 are designated by the same reference numerals. In this case, the discharge circuit of the measuring tube 2 contains a regulating valve 9 having a control grid 10, the potential of which is so varied in accordance with the discharge current of the measuring tube 2 that the anode current of the control valve 9 decreases as the discharge current increases and increases as the discharge current decreases. For this purpose, there is provided in association with the measuring tube 2 a series resistance 11, the voltage drop of which varies with the discharge current of the measuring tube 2 and thus influences the grid potential of the valve 9 through a constant biassing voltage source 13. In the illustrated arrangement, there is also provided in association with the voltmeter 8 a resistance 12 which is so dimensioned that it compensates for the voltage drop occurring across the series resistance 11 of the measuring tube 2. There is also provided a resistance 14 which is of such value, for example, that the voltage drop across the resistance 12 is as large as the voltage at the measuring tube 2 and the series resistance 11 at the highest pressure to be measured, for example 10^{-1} mm. mercury. In this case, the instrument shows no deflection, but the pressure scale commences with the zero needle position. However, other balancing values of the resistance 14 are also possible. If a suitably dimensioned uni-directional conductor is connected in parallel in the forward direction with the measuring instrument employed for the pressure measurement, the calibration curve of the measuring instrument may be so modified that each pressure decade covers substantially an equal fraction of the measuring scale. A circuit diagram for this arrangement is given in Figure 4. The same reference numerals are employed for parts identical with those in Figure 3. In this case, 15 is the instrument employed for the pressure measurement, with which a series resistance 16 is associated. A germanium uni-directional conductor is here connected in parallel with the instrument to effect the aforesaid modification of the calibration curve of the instrument 15.

What we claim is:—

1. An arrangement for measuring low pressures with an ionisation gauge having a cold cathode, particularly for the measurement of pressures of up to 10^{-1} mm. mercury, wherein there is provided in association with the measuring tube an automatic regulator which adjusts the discharge current to a constant value, and wherein a continuous pressure measurement is effected by the measurement of the voltage at the measuring tube, or across the measuring tube and a series resistance associated therewith.

2. An arrangement as claimed in Claim 1, wherein the voltmeter employed for the pressure measurement is calibrated in pressure units.

3. An arrangement as claimed in Claim 1 or Claim 2, wherein the discharge circuit of the measuring tube contains a regulating valve having a control grid, the potential of which is so varied in accordance with the discharge current that the anode current of the control valve decreases with increasing discharge current and increases with decreasing discharge current.

4. An arrangement as claimed in Claim 3, wherein the voltage drop varying with the discharge current of the measuring tube, across a series resistance associated with the measuring tube, influences the grid potential of the regulating valve through a constant biassing voltage source.

5. An arrangement as claimed in any of the preceding Claims, wherein there is connected in series with the voltmeter employed to measure the pressure a resistance which is of such value that it compensates for the voltage drop occurring across the series resistance of the measuring tube.

6. An arrangement as claimed in any one of the preceding claims, wherein a uni-directional conductor is connected in parallel in the forward direction with the measuring instrument employed for the pressure measurement, so that the calibration curve is so modified that each pressure decade is covered by a substantially equal fraction of the scale.

7. A method of measuring low pressures with an ionisation gauge having a

cold cathode, particularly for the measurement of pressures of up to 10^{-1} mm. mercury, substantially as hereinbefore described.

8. An arrangement for carrying out the method of measuring low pressures with an ionisation gauge having a cold cathode, particularly for the measurement of pressures of up to 10^{-1} mm. mercury constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings.

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722.788 COMPLETE SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

Fig. 1

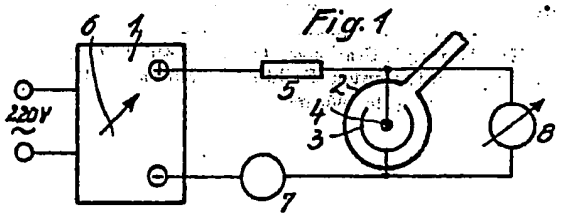

Fig. 2

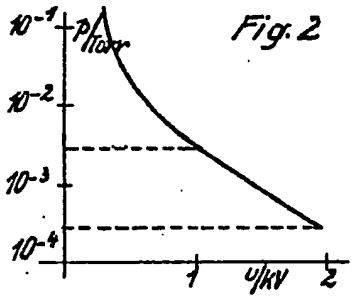

Fig. 3

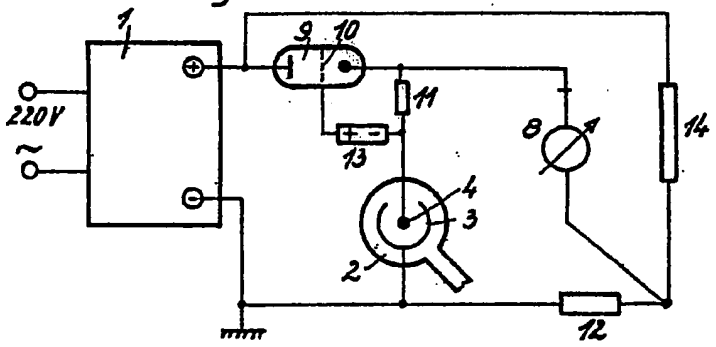

Fig. 4